SYNOPSIS

Title :

Characterization and Management studies of *Parthenium hysterophorus*

Introduction :

Genus *Parthenium* is represented by its fifteen (15) species world over under the sub tribe Ambbrosiinae in the tribe Heliantheae of the family Astraceae. The species of *Parthenium* are mainly the natives of America and the West Indies. Only one of its species i.e. *Parthenium hysterophorus* is found in India, which is reported to be introduced accidentally around fifties of 20th century with imported grains from U.S.A. or Canada. Since then it has spread over most part of the country, infesting agricultural lands, road sides, waste areas and disturbed the ecosystems.

The scientific studies have revealed that pollens, trichomes and other parts of *Parthenium hysterophorus* contain certain chemical like **sesquiterpene lactone** (Rodriguez, 1977) that is harmful human and other livestocks (Auld and Medd 1987). It causes asthma (respiratory issues), skin allergies such as allergic eczematous, contact dermatitis and allergic rhinitis, mental depression, bronchitis and hay-fever etc. in man and other livestock.

Morphological studies of different parts of *Parthenium* plant such as root, stem, leaf and inflorence has revealed the presence of chemicals responsible for toxic effects in mammals (Veena B. and Shivani Maurya, 2010). So it is necessary to carry out Chemical analysis and characterize each parts of *Parthenium* plant by different sophisticated instrumental techniques such as Fourier Transform Infrared Spectroscopy (FTIR), powdered XRD (X-ray diffraction), Scanning Electron Microscopy (SEM) in order to assess their respective toxic effects (Edwin et al., 2024, Maturi KC et al., 2022, Miguel A. et al, 2022) to human beings and livestocks.

Ever since the parthenium weed became a menace around the globe including India, efforts have been made to manage the weed employing different methods such as mechanical, competitive replacement (allelopathy), chemical, and biological control methods. However, the weed has defied all human efforts to control it due to one or other disadvantages. Biological control, the intentional manipulation of natural enemies, insects, bioherbicides, nematodes, snails, and competitive plants to control

harmful weeds, is gaining momentum as it is an effective and ecofriendly alternative to conventional methods of parthenium weed control (Kumar, 2009).

Review of literature : The weed *Parthenium hysterophorus* L., is popularly known as Congress Grass, Carrot Weed, Chatak Chandni, Gajar ghas, Ghandhi booti, White top (Dhawan, 1988) Worm weed, White head, Mutter Kranti, Absinthe Marron & Yerba amaega (Henson del orbe, 1977) Pandhari Phule, Witches broom, Safed topi ,Feverfew, Osadi, Machipatri (Singla, 1992, 1996 and 2000) Cosmopolitan weed, National culprit and National Health hazard (Singh and Kaur, 1997). The accidentally introduced weed is believed to have entered the Indian soil sometime during 1955 along with wheat sent by USA under PL-480 (Public Law 480 passed in 1954 to give food grains to developing countries).

As per herbarium specimen at F. R. I. Dehradun, the plant was present in India well before the beginning of 20th century (Roxburge , 1914, Bennet *et al.* 1978). Prof. Paranjape, a retired Horticulturist, in 1955 observed as a stray plant on the rubbish heaps in the neighbourhood of the Agricultural College, Poona. This belief was put forth by Rao (1956) based on the observations of Prof. Paranjape and this weed was identified as *Parthenium hysterophorus L.*

It is not only a pernicious weed of immense crop damaging potential, but also poses a serious threat to human beings and livestock leading to socio-psycho economic problems. Its spread throughout the country has been very rapid with abnormal density.

The wide and prolific spread of *Parthenium hysterophorus* to almost all parts of India in such a shorter span of time is mainly attributed to its allelopathic effects as well as its shorter life cycle with massive seed production. A single *Parthenium hysterophorus* plant with its indeterminate flowering habit and extended period of flowering is reported to bear a minimum 75000 seeds during its entire lifetime. Its massive seed production habit accompanied with the absence of its natural enemies has generated the actual concern.

More than two decades ago, serious human health risks from *P. hysterophorus* were reported from India (Lonkar *et al.*, 1974), and 12 deaths were attributed to allergenic responses, particularly flu and asthma, from Poona alone (Anonymous, 1976). The initial symptoms

were described as itching, redness, swelling and blisters on the eyelids, face and neck, which then spread to the elbows and knees. In the later stages, the skin thickens and darkens. "At present there is no cure for the disease other than moving away from the *parthenium* infested area" (Anonymous, 1976). Since then there has been a series of publications on the impact of *parthenium* weed on the welfare of human populations, which has steadily accumulated evidence indicating that this is a much more serious problem than originally supposed.

Parthenium can cause acute allergic eczematous / contact dermatitis and respiratory problems in human, which under continued exposure becomes chronic (Mahadevappa, M.,1999). While the pollen of the grass can set off an attack in asthma patients, contact with the bush can cause skin allergy called phytophoto dermatitis or in the simple terms **Air-Borne Contact Dermatitis** (ABCD). While itching is the most common symptoms of the allergy, other symptoms include cracking, scaling or thickening of the skin. Airborne pollens of *Parthenium* play a major role in the pathogenesis of respiratory allergic diseases. Prolonged skin contact with parthenium can result in **allergenic eczematous contact dermatitis (AECD)**, whilst inhalation of pollen can cause allergenic rhinitis which can develop into bronchitis or asthma if the pollen enters the respiratory tract during mouth breathing.

Parthenin is considered to be the major allergen of the species (Lonkar *et al.* 1974). A number of other sesquiterpene lactones have also been isolated, including hymenin, coronopilin, hysterin, and tetraneurin A (Rodriguez *et al.* 1976b, Picman et al. 1984, Towers *et al.* 1977). The principal culprit, **parthenin**, has enhanced biological activity (**toxicity**) due to the presence of a cyclopentene group, which can cause chromosomal damage in animal cells, uncouple phosphorylation and inhibit key cellular enzymes. Indeed, extremely small doses injected intravenously into mice can cause rapid death.

Objectives : The present research work proposes to characterize the four main parts (root, stem, leaf and inflorence) of Parthenium plant in details with different sophisticated instrumental techniques such as Fourier Transform Infrared Spectroscopy (FTIR), XRD (X-ray diffraction), Scanning Electron Microscopy (SEM) in order to assess their respective toxic effects. It would pave the way to understand the mechanism and nature of toxic effects on human beings and livestock.

The aim of this present research work is to provide information about the physiology, distribution, ill effects, and management of parthenium. Control of parthenium has been tried by various methods, but no single management option has been adequate to

manage parthenium, and there is a need to integrate various management options. Biological control is the intentional manipulation of natural enemies by man for the purpose of controlling harmful weeds. Successful management of this weed can only be achieved by an integrated approach with biological control as the key element. The biological control using *Zygogramma bicolorata* has emerged one of the most promising methods.

Plan of work :

1. Parthenium plant identification, separation of different parts (root, stem, leaf and inflorence), preparation of tests samples (dry samples and extract)
2. Chemical analysis of different parts of *Parthenium hysterophorus* plant using different instrumental techniques such as N.M.R., Thin Layer Chromatography and C.E. (Capillary Electrophoresis).
3. The extract of leaf and inflorence of the *Parthenium* plant would be analysed by FT- IR by scanning in the frequency range of 4000–400 cm^{-1}
4. The surface morphology analysis would be carried out by Scanning Electron Microscope (SEM).
5. The nature of the *Parthenium* plant samples would be irradiated with a monochromatic CuK_{α} radiation of 0.1542 nm, and the diffractograms were acquired between 2θ values of 5°–90° at 0.05° intervals with a measurement time of 1 second per2θ intervals.
6. The biological control method using *Zygogramma bicolorata* would be attempted at different locations and climatic conditions.

The C.S.I.R. Research Laboratories such as A.M.P.R.I., Bhopal, N.M.L. Jamshedpur would be approached for testing of our *Parthenium* samples using above mentioned instrumental techniques.

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Signature of Research scholar

(Sovind Kumar)

Signature of Supervisor

(Dr. Sabita Verma)

Dated :